Technical Report : Series 'D'

No. 59

GOVERNMENT OF INDIA
Central Ground Water Board
Ministry of Water Resources

HYDROGEOLOGICAL REPORT OF DEPOSIT WELL CONSTRUCTION IN SOUTH & NORTH CHOTANAGPUR DIVISION, BIHAR, UNDER SPECIAL DROUGHT RELIEF PROGRAMME

(FS 1979-80 & 80-81)

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DECEMBER, 1987

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I. INTRODUCTION

As per the advice of Shri S.P. Mukherjee, Additional Secretary(RC) to the Government of India, Ministry of Agriculture & Irrigation (Deptt. of Agriculture), Chief Hydrogeologist & Member of Central Ground Water Board has attended the meeting held under the Chairmanship of His Excellency the Governor of Bihar on 4-12-1979. The Governor briefly reviewed the drought situation as was prevailing in Bihar State and informed that all possible resources were being mobilised for providing drinking water supplies for the people. Central Ground Water Board had been advised to carry out drilling on priority basis for construction of deep borewells in hard rock areas. It was also stressed that in order to minimise the chances of failure the sites should be selected by a hydrogeologist only.

Accordingly the programme of F.S.P. 1979-80 has been re-oriented so as to carry out hydrogeological, geophysical and photogeological investigations for selecting sites for drilling borewells for water supply. Three D.T.H. rigs were deployed for constructing borewells in hard rock areas. The area of operation was only the South Chotanagpur Division in the begining but later on the North Chotanagpur Division was also included.

The author was assigned the work of pinpointing the borewell sites along with representatives of Deputy Commissioner of the respective districts and Executive Engineer, CGWB, Division-V, vide letter No.PA/CH/CGWB/Tour Note/8075 dt. 9-12-79. The work carried out during the period January 1980 to June 1980 in the districts of Ranchi, Palamau, Singhbhum and Hazaribagh are summarised in this report along with the basic data collected from the boreholes drilled.

As the geology of the area is very complex the Director CGWB, ER, had deputed geophysical parties to the area for conducting resistivity surveys to assist in pin-pointing the favourable sites.

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II. GEOGRAPHIC LOCATION

The area is included in Survey of India Topographical Sheet Nos. 63P, 72D, 72H, 73A, 73B, 73E and 73F. It is bounded by N. latitudes 22°00'00" & 25°00'00" and E.longitudes 83°00'00" & 87°00'00".

The area is well connected by rail, road and air. The location map of the borewell sites is also enclosed.

III. PHYSIOGRAPHY & CLIMATE

The area comes under North Koel, South Koel, Subarnarekha, Sankh and Damodar river basins. Broadly the area is covered by a physiographic unit called Chotanagpur Plateau. The general elevation of the plateau is 660 m above mean sea level at Ranchi. The average normal rainfall is given below

Ranchi - 1512.17 mm.

IV. GEOLOGY

The area is mostly underlain by granite gneiss, mica-chlorite schist, phyllite, calc-sillicate and hornblende gneiss which have been at places intruded by pegmatite and quartz veins. At places it is covered by alluvial zone thin composed of fine to coarse grained sand and clay followed by weathered and fractured granite gneiss. Extensive patches of Gondwana formations composed of sandstones, shale and coal seams occur in the northern part of the area covered in Palamau & Hazaribagh districts. Based on the borehole data obtained a generalised lithological profile in the hardrock area is described below :

I.	Seil zone	: Sandy / clay or clayey sand impregnated with organic matter.
II.	Decomposed zone	: Altered massive clays, some primary minerals may be present in their original form. High porosity but low permeability.
III.	Disinte. grated zone	: Progressively altered from the fresh rock upwards into granular friable layers of disintegrated crystal aggregate and rock segments. Has low porosity but appreciable permeability.
IV.	Fractured zone	: Fresh rock, often fractured. Has moderate to low fracture porosity and permeability.

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V. HYDROGEOLOGY

Due to heterogenus nature of the rock types encountered in the area, the hydrogeology of the area is highly varied and complex. However, it was found that the disintegrated zone and the fractured zones form potential aquifers in the area underlain by hard rocks.

Well design

No well assembly is lowered in the borewell, only the top zone I & II are cased with blank casing pipe.. In some borewells parts of zone III is also cased and the rest of the borehole was left uncased.

Pumping test

After proper development the borewells were subjected to pumping test in order to compute the specific capacity of the well and aquifer parameters.

VI. SITE SELECTION

Sites for the deposit wells are selected in each locality after studying the local geology and hydrogeology thoroughly. As the disintegrated zone and fractured zones form potential aquifers in hard rock terrain, it was the main endeavour to find out such sites where these two zones appear to be of maximum thickness. It was generally found that low lying, broad valleys are more favourable sites than high grounds or sloping terrain. After locating such favourable sites, geophysical resistivity surveys were carried out. Due to limitation of time only Vertical Electrical Soundings (VES) were done at a few points in the favourable sites and the most suitable spot was pinpointed for drilling.

VII. QUALITY OF WATER

The water samples from borewells were collected and the same was subjected to chemical analysis. The quality of water in all the borewells were found to be good for domestic purposes. Drilling was carried out at 18 sites after detailed hydrogeological survey.

The location of these sites are shown in plate-I and the summarised hydrogeological data are presented in Table-I.

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Table-I

Hydrogeological data of Borewells constructed under drought programme, Bihar

Sl. No.	Location (coordinate)	District	Depth drilled (m)	Depth of casing (m)	Rock Type	Non-pumping water level (BMP) (m)	M.P. Top of casing pipe (m)	Discharge during drilling (LPH)	Discharge (LPH) (Pumping test)	Draw-down (m) (Pumping test)	Sp. capacity (LPM/M)	Recommended safe pumping rate (LPH)	Period of construction
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	DORANDA	RANCHI	75.20	15.20	Granite gneiss	4.40	0.50	14400	16920	25.96	10.8	16920	2-1-80 to 5-1-80
2.	KHUNTI	- do -	68.75	12.85	- do -	4.70	0.50	14400	18560	16.69	18.5	18560	15-1-80 to 7-2-80
3.	HEHAL	- do -	75.25	13.45	- do -	4.50	0.45	1200	No pumping test conducted due to low discharge			(Hand pump)	15-2-80 to 29-2-80
4.	SIMDEGA	- do -	75.20	25.80	- do -	5.00	0.50	3600	5400	18.43	4.9	5400	5-2-80 to 17-2-80
5.	LOHARDAGA	- do -	75.00	9.80	- do -	1.86	0.50	18000	23620	22.77	17.0	22710	6-3-80 to 2-4-80
6.	JUGSALAI (Jamshedpur)	SINGHBHUM	74.45	20.30	Mica-chlorite Schist	6.40	0.30	18000	16920	23.85	11.8	15140	14-1-80 to 17-1-80
7.	MANGO (Jamshedpur)	- do -	75.20	20.60	Mica-chlorite-Phyllite Schist	7.60	0.45	1800	1892	21.32	1.4	1892 (Hand pump)	18-1-80 to 23-1-80
8.	GAMHARIA	- do -	79.20	8.40	Phyllite-Mica-chlorite Schist	3.90	0.60	7200	7560	26.00	4.8	7560	25-1-80 to 27-1-80

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1	2	3	4	5	6	7	8	9	10	11	12	13	14
9.	KULUPTANGA (Adityapur)	SINGHBHUM	75.00	20.60	Phyllite-Mica-Chlorite Schist	0.50 (AGL)	0.40	1800	5677	24.79	3.8	5677	28-1-80 to 31-1-80
10.	HORIZON HOSTEL (Daltanganj-I)	PALAMAU	75.20	9.50	Granite gneiss	5.20	0.50	1800	5677	14.97	6.35	5677	21-2-80 to 28-2-80
11.	SHIVMANDIR (Daltonganj-II)	- do -	75.20	11.60 (including 6.12 m slotted)	- do -	4.40	0.35	7200	7570	25.00	-	7570	3-3-80 to 16-3-80
12.	GARHWAH	- do -	75.20	10.10	Gondwana Shale/ sandstone	3.70	0.40	36000	26116	13.30	32.7	26116	20-3-80 to 22-3-80
13.	HUSSAINABAD (Japla)	- do -	74.45	30.10 (including 11.38 m slotted)	Alluvium/ Granite gneiss	9.70	0.40	18000	21000	14.78	23.7	21000	6-4-80 to 19-4-80
14.	CHATERPUR	- do -	75.20	12.20	Granite gneiss	6.40	0.30	600	No pumping test conducted due to low discharge		(Hand Pump)		25-4-80 to 22-4-80
15.	SAVODAY COLONY (Hazaribagh-I)	HAZARIBAGH	75.20	25.30	Granite gneiss/ Pegmatite, hornblende gneiss	9.80	0.30	14400	11355	15.76	12.0	11355	6-5-80 to 16-5-80
16.	OKANI (Hazaribagh-II)	- do -	75.20	15.20	- do -	4.10	0.30	7200	7040	19.86	5.90	7040	23-5-80 to 24-5-80
17.	KORRAH (Hazaribagh-III)	- do -	75.20	13.20 (including 5.80m slotted pipe)	- do -	1.05	0.50	20000	22710	26.94	14.04	22710	26-5-80 to 7-6-80
18.	KHIRGAON (Hazaribagh-IV)	- do -	75.20	20.40	- do -	5.35	0.30	1080	No pumping test conducted due to low discharge		(Hand Pump)		17-6-80 to 22-6-80